The Ramsey Test and Evidential Support Theory

Michał Sikorski

April 5, 2022

Abstract

The Ramsey Test is considered to be the default test for the acceptability of indicative conditionals. I will argue that it is incompatible with some of the recent developments in conceptualizing conditionals, namely the growing empirical evidence for the *Relevance Hypothesis*. According to the hypothesis, one of the necessary conditions of acceptability for an indicative conditional is its antecedent being positively probabilistically relevant for the consequent. The source of the idea is *Evidential Support Theory* presented in Douven (2008). I will defend the hypothesis against alleged counterexamples, and show that is it supported by growing empirical evidence. Finally, I will present a version of the Ramsey test which incorporates the relevance condition and therefore is consistent with growing empirical evidence for the relevance hypothesis.

1 Introduction

The Ramsey Test (RT) was presented by Ramsey (1990) as a procedure for evaluating the acceptability of indicative conditionals:

> "If two people are arguing 'If p will q' and both are in doubt as to p, they are adding p hypothetically to their stock of knowledge and arguing on that basis about q; so that in a sense 'If p, q' and 'If p, $\bar{q}$' are contradictories. We can say that they are fixing their degrees of belief in q given p."(Ramsey, 1990, p. 155.)

According to the standard interpretation of this passage (see e.g., Gibbard, 1981a, Edgington, 1995, or Bennett, 2003), the sufficient and necessary condition for acceptability of an indicative conditional "If A, B" is that a conditional probability $Pr(B|A)$ is high. This can be put in the form of *Qualitative Adams Thesis*:

(QAT) An indicative conditional "If A, B" is assertable for/acceptable to a person if and only if the person's degree of belief in $Pr(B|A)$ is high.[1]

Even today, RT is widely discussed. For example, Fuhrmann and Levi (1994) present a class of conditionals that are assertable but RT judges them as not assertable and proposes a different version of the test. At the same time, because of its intuitiveness but also simplicity, RT served as a direct inspiration for three successful research programs: belief revision theory (for discussion see e.g., Fermé and Hansson, 2011), possible world semantics (e.g., Stalnaker, 1968), and suppositional theories of indicative conditionals (e.g., Adams, 1975), and it is still considered to be the default test for the acceptability of conditionals (see e.g. Bennett, 2003 or Evans and Over, 2004).

I will argue that RT is not compatible with recent developments in the epistemology of conditionals, namely, the idea that one of the conditions of acceptability of conditionals is that the antecedent is positively probabilistically relevant for the consequent, which I will call the relevance hypothesis. As far as I know, this idea was first introduced in (Douven, 2008). In the article, Douven presents the Evidential Support Theory which incorporates an additional condition of acceptability of conditionals: positive probabilistic relevance. The theory was supported by results of the experiment described in Douven and Verbrugge (2012). I will argue that RT does not incorporate the probabilistic relevance requirement, and therefore is not an adequate test for the acceptability of conditionals. Then, I will present an improved version of RT that does incorporate the relevance condition.

In the second section, I will introduce the notion of probabilistic relevance and present the Evidential Support Theory and the Relevance Hypothesis. In the third section, I will discuss a few alleged counterexamples to the Relevance Hypothesis. In the fourth section, I will present the counterexamples to RT inspired by the Relevance Hypothesis and a version of RT which incorporates the Relevance Hypothesis.

[1] The source of this formulation is Douven (2008).

2 Evidential Support Theory and Relevance Hypothesis

The main claim of the Evidential Support Theory is the Evidential Support Thesis (EST):

EST An indicative conditional "If A, B" is assertable/acceptable if and only if $Pr(B|A)$ is not only high but also higher than $Pr(B)$.[2]

The theory is supported by the results of an experiment described in (Douven and Verbrugge, 2012). During the experiment, sixty-two participants were presented with 18 items. Each item consisted of three questions: the first two were about the probabilistic relation between two events and the last one was about the acceptability of indicative (and concessive) conditionals with these events as antecedents and consequents.

The authors compared the participants' answers with the predictions of QAT. The results clearly support EST, and to a much lesser extent QAT. According to the authors, the results show that QAT identifies only a part of the acceptability conditions of indicative conditionals. The missing part is the condition of positive relevance added in EST. Probabilistic relevance can be conceptualized in at least two ways.

Firstly, we can use $\Delta P = P(B|A) - P(B|\neg A)$ proposed in Cheng (1997).[3] If the value of ΔP is 0, the corresponding conditional is irrelevant. When it is higher, then it is positively relevant, and when it is lower, the conditional is negatively relevant. Secondly, the relevance can be conceptualized as a difference measure $P(B|A) - P(B)$. The difference measure was used by Douven to express the additional requirement of positive relevance in EST. As in the case of ΔP, when the value of the difference measure is 0 the conditional is irrelevant, if it is lower it is negatively relevant and if it is higher it is positively relevant. Both conceptualizations classify conditionals in the same way but the exact level of relevance will differ in some cases.[4] Both explications have been used in the literature and the difference will not matter for our conclusions. Other ways of conceptualizing relevance were also

[2] I use the version from Douven and Verbrugge (2012).

[3] This conceptualization was used in context of conditionals for example in Oberauer, Weidenfeld, and Fischer, 2007 or Spohn, 2012.

[4] For a detailed discussion of the difference between the two notions and an experiment indicating that ΔP predicts intuitive relevance better than the difference measure, see Skovgaard-Olsen, Singmann, and Klauer (2017).

used in the literature. For instance, causal measures were used in (van Rooij and Schulz, 2019).

With the notion of probabilistic relevance in hand we may clearly state the addition made in EST to QAT:

RH A positive relevance ($\Delta P = (P(B|A) - P(B)) > 0$) is a necessary condition for an indicative conditional $A \rightarrow B$ to be acceptable.

I will call this claim the Relevance Hypothesis (RH). Since, EST is supported by the results of the experiment (Douven and Verbrugge, 2012), and that the only difference between QAT and EST is that EST incorporates RH, the experiment indirectly support RH. Additionally, the existing evidence suggests that the probabilistic relevance influences the assessments of both probability and graded quantitative acceptability of conditionals (see e.g., Skovgaard-Olsen, Singmann, and Klauer, 2016, Skovgaard-Olsen, Kellen, Krahl, and Klauer, 2017, Skovgaard-Olsen, Singmann, and Klauer, 2017 or Vidal and Baratgin, 2017). For a long time it has been generally believed that graded acceptability correlates with conditional probability in line with the *Adams Thesis* (see e.g., Jackson, 1987 or Edgington, 1995):

AT $ac(A \rightarrow B) = P(B|A)$

Recent studies suggest that AT does not hold in the case of irrelevant and negatively relevant conditionals (see e.g., Skovgaard-Olsen et al., 2016). The acceptability of such conditionals is systematically judged to be lower than the corresponding conditional probability. In light of such results, it seems natural to expect that qualitative acceptability is affected in an analogous way by probabilistic relevance, in line with RH.

Finally, RH was incorporated in some of the newer theories of conditionals (for example, van Rooij and Schulz, 2019) and additional empirical results supporting it were reported (see e.g., Krzyżanowska, Collins, and Hahn, 2017).

3 Counterexamples to the Relevance Hypothesis

RH is controversial despite growing empirical support for it. Two strategies of arguing against it are present in the literature. Firstly, one can look for an example of an acceptable conditional which clearly does not involve a positive relevance. Secondly, one can try to find a valid argument from premises that do not involve relevance, to acceptable conditionals.

Let us start with the first strategy. An example of two conditionals which were judged to be acceptable but cannot both be positively relevant is provided in the Gibbard phenomenon:

> Sly Pete and Mr. Stone are playing poker on a Mississippi riverboat. It is now up to Pete to call or fold. My henchman Zack sees Stone's hand, which is quite good and signals its content to Pete. My henchman Jack sees both hands and sees that Pete's hand is rather low so that Stone's is the winning hand. At this point, the room is cleared. A few minutes later, Zack slips me a note which says "If Pete called, he won," and Jack slips me a note which says "If Pete called, he lost." I know that these notes both come from my trusted henchmen, but do not know which of them sent which note. I conclude that Pete folded.
> (Gibbard, 1981b, p. 231.)

According to Gibbard's original interpretation, the evidence Jack and Zack have for both conditionals are equally strong. On the other hand they cannot be both true, this would lead together with a plausible conditional non-contradiction rule:

CNC $\neg((A \to \neg B) \wedge (A \to B))$

to a contradiction. Therefore, he concludes that both conditionals are acceptable and sees the phenomenon as an argument for a popular philosophical position called the non-truth value view, which claims that conditionals are not truth-apt (see e.g., Bennett, 2003 or Edgington, 1995).

The phenomenon is very controversial and alternative interpretations were proposed. Firstly, Lycan (2003) denies that the support for both conditionals is symmetric and therefore claims that one of them is true, and therefore acceptable, while the second one is false, and therefore not acceptable.

Secondly, following van Fraassen (1976), Stalnaker (1988) or Krzyżanowska, Wenmackers, and Douven (2014) one can claim that the meaning of conditionals depend on the beliefs of the speaker. In the case described by Gibbard, it is clear that both Zack and Jack based their conditionals on different beliefs based on different evidence. Because of that, both conditionals despite their superficial form are not in any tension and therefore are not inconsistent even when combined with CNC. To put it differently, according to this interpretation $A \to B$ and $A \to (\neg B)$, are not a proper formalization of the conditionals from the story, they are based on different beliefs and therefore they express different relations.

How is this example connected to RH? According to both conceptualizations of relevance, it is not possible for $A \to B$ and $A \to \neg B$ to be both probabilistically relevant at the same time. Therefore, if both conditionals are acceptable and their logical form is $A \to B$ and $A \to \neg B$ we would have a clear counterexample to RH. At the same time, the example is equally problematic for QAT, two sentences of such form cannot have both high conditional probability at the same time.

Still, the phenomenon is very controversial. Speakers' intuitions in such cases were, as far as I know, never tested so it is not clear if Gibbard's intuition is generalizable.

A different kind of counterexamples are sentences such as:

(1) If it will not rain tomorrow, I will go to the beach. And, if it will rain tomorrow, I will go to the beach.

Bennett uses such sentences to defend RT against an objection similar to one developed here (see Bennett, 2003 p. 122–124). He admits that there is a class of conditionals that are not positively relevant but have a high corresponding conditional probability because the unconditional probability of the consequent is high. He calls such conditionals non-interference indicative conditionals and claims that they are acceptable despite being unintuitive. His example is:

(2) If it is snowing in Auckland now, ripe bananas are usually yellow.

Bennett claims that in some cases, both conditionals in (1)-like conjunctions can be acceptable at the same time.[5] Both conjuncts, are supposed to be acceptable for a person which is sure that the consequent (beach trip) of

[5]The examples Bennett used are: "If George told them about our plan, he broke a promise to me." and "If he didn't tell them about our plan, he broke a promise to you.", where "me" and "you" refer to the same person.

both conditionals will happen no matter the truth value of the antecedent (presence or absence of rain). If such conditionals are in fact acceptable they constitute a clear counterexample to RH, both $(\neg A) \to B$ and $A \to B$ cannot be positively relevant at the same time and show that some of the non-interference conditionals are acceptable. According to Bennett, acceptability of (1)-like pairs of conditionals shows that neither connection nor probabilistic relevance is required for a conditional to be acceptable. He claims that this explains why some of the non-inferential conditionals are acceptable despite being ,,stupid-to-say".

Just as in the case of the Gibbard phenomenon, there are no empirical studies that show that the users of the natural language are willing to accept such conjunctions. Even if such expressions are systematically acceptable in some contexts it is not obvious that they express conjunction of indicative conditionals. For example, it may be the case that by means of them speakers express something like:

(3) If it will not rain tomorrow, I will go to the beach and even if it will rain tomorrow, I will go to the beach.

In such a case, despite their superficial structure, (1)-like utterances are not conjunctions of two indicative conditionals, but conjunction of an indicative conditional and a concessive one (conditional which involve "even if" clause) and therefore are not counterexamples to RH. Such readings seem to be plausible. To show that the (1)-like conjunctions are conjunctions of indicative conditionals, one would have to show that in the contexts in which a speaker is willing to assert them, she is also willing to assert each of the combined conditionals on their own. This would show that both $\neg A \to B$ and $A \to B$ are acceptable, which would constitute evidence against RH. At the same time, we have empirical results which strongly suggests that (2)-like conditionals are systematically judged as unacceptable by participants (see e.g., Douven and Verbrugge, 2012, Krzyżanowska et al., 2017 or Douven, Elqayam, Singmann, and van Wijnbergen-Huitink, 2019), which shows that Bennett's defence of such conditionals based on dubious intuitions falls short.

Two other counterexamples to RH were discussed in (Skovgaard-Olsen, Collins, Krzyżanowska, Hahn, and Klauer, 2019). The authors discuss counterexamples to the idea that the acceptability of an indicative conditional requires the existence of a connection between the antecedent and the consequent. Probabilistic relevance is typically understood as a way to conceptualize this connection so it is safe to assume that if the antecedent is not connected to consequence it is also not probabilistically relevant for it. Therefore a convincing example of an acceptable conditional which does not involve any connection will be an example of a conditional which does not involve relevance. The first discussed example was originally presented in (Johnson-Laird and Byrne, 2002):

> We do not deny that many conditionals are interpreted as conveying a relation between their antecedents and consequents. However, the core meaning alone does not signify any such relation. If it did, then to deny the relation while asserting the conditional would be to contradict oneself. Yet, the next example is not a contradiction: If there was a circle on the board, then there was a triangle on the board, though there was no relation, connection, or constraint, between the two-they merely happened to co-occur. (p. 651)

Acording to Skovgaard-Olsen and co-authors, Johnson-Laird and Byrne are mistaken in claiming that there is no connection involved in the described example. The co-occurrence mentioned in the quote is the connection that justifies the utterance of the conditional. This seems to be a convincing response and considering probabilistic relevance makes it even clearer. The correlation between two shapes makes the occurrence of the circle positively relevant for the occurrence of the triangle.

The second counterexample was suggested to Skovgaard-Olsen and coauthors by an anonymous reviewer. It meant to be another example of an acceptable conditional which does not involve connection:

> Detective interviewing shopkeeper:
>
> D: We need to know what Mr. Smith bought today, can you help us out?
>
> S: I'm sorry, I didn't find out about any customers' names today.
>
> D: Well, he was carrying a large polka-dotted umbrella.
>
> S: If he carried a polka-dotted umbrella, then he bought a gold watch.

The authors agreed that in general there is no relation between carrying a polka-dotted umbrella and buying a gold watch but claim that the conditional still involves a connection. It is established by salesmen (S) learning from the detective (D) that Mr. Smith was the man who was carrying a polka-dotted umbrella. This addition makes the arguments of the conditional connected in this context. The salesmen knows what Mr. Smith looked like and what person with this specific look bought. This connection secures the positive relevance and is the basis on which the salesmen asserts the conditional.

Another counterexample was suggested by one of the reviewers of this article, and involves sentences like:

(4) If 2+2=4, then 2+2+1=4+1.

(5) If the Louvre is in Paris, then the Louver is in France.

Both conditionals seem to be acceptable even when uttered by a person whose subjective probability of the consequent is 1. Such utterances may be used by a teacher while teaching her children. If her subjective probability of consequent was 1, then it cannot be further increased by the truth of the antecedent. Therefore, such conditionals cannot be positively relevant. Such cases are harder to explain than the previous one, but perhaps it is still possible to explain them. One may claim that in such cases, conditionals such as (4) or (5) are assessed from the perspective of children rather than from the perspective of the teacher. Such students are not yet certain about the truth of the consequent and therefore they may benefit from learning the relation between the two sentences. If students are certain that the consequent is true, then it seems that such assertions are far less useful. What anybody learned from them, and if nothing, what was their purpose? Consequently, it is far less clear if such conditionals asserted by a speaker certain that the consequent is true to an audience equally convinced that it is true are acceptable.

This way of defending RH against the counterexamples, like (4) or (5), falls short in light of the results of the recent experiments presented in Krzyżanowska, Collins, and Hahn (2021). The results strongly suggest that conditionals with true antecedents and consequents are judged as true by natural language users when their arguments are connected. This suggests that connection characterizing true conditionals cannot be captured by probabilistic relevance and therefore RH is not generally true. Perhaps RH can still be saved by changing how the probability of arguments with known values is interpreted? It seems that a hypothetical probability can be used in cases of conditionals containing arguments with known values. Such hypothetical probability can be obtained by suspending the beliefs concerning the arguments in question and estimating how probable they are in light of this suspension. For example, in the case of (5) if one knows that Louver is in France then her subjective probability of sentence "Louver is in France." equals 1 and cannot be increased by accepting any other sentences and therefore no sentence can be positively probabilistically relevant for it. On the other hand, if someone will suspend her judgment concerning sentences "Louver is in Paris." and "The Louver is in France." and on the basis of the rest of her knowledge assess if the hypothetical probability of "The Louver is in France." increase when the sentence "Louver is in Paris." is accepted, most likely she will find that in fact, it will. That is precisely the result the proponents of RH would hope for. This strategy seems to be equally successful in the other cases, for example, one of the conditionals used in Krzyżanowska et al. (2021):

(6) If roses are plants, then roses have thorns.

If someone suspends her judgments concerning the truth of arguments of the (6) and consider how accepting antecedent would influence the hypothetical probability of consequent then plausibly she would arrive at a conclusion that such acceptance would not change such probability, being a plant is not connected and therefore is probabilistically irrelevant to having thorns, and therefore conditional is not acceptable. Once again, the result seems to be correct which suggests that relations between the hypothetical probability of arguments preserve our intuitions concerning absence and the presence of a connection between them. This strategy of saving the RH seems to be justified in the context of RT, as it also incorporates an operation of accepting beliefs hypothetically. Secondly, as I will show in the fourth section, this solution can be easily incorporated into a new version of the Ramsey test that will be able to incorporate the RH.

An example of a reasoning which is credited with being a counterexample to the RH is the *Conjunctive Sufficiency*, also called centering:

CS $A \wedge B \models A \to B$

As we have seen, CS is an inference that takes us from a conjunction to the conditionals from one of the conjuncts to another one. Relevance is neither required for the truth nor for the acceptability of the conjunction, so if the inference is valid, the relevance cannot be a part of the acceptability conditions for conditionals. CS is validated by most of the popular semantics of indicative conditional, for example possible world semantics (see e.g., Stalnaker, 1968) or three-valued semantics (see e.g., Baratgin, Politzer, Over, and Takahashi, 2018 or Egré, Rossi, and Sprenger, 2019). On the other hand, some authors regard CS to be unintuitive and developing semantic theories which do not validate it. An example of such theory is a promising inferential semantics defended in Krzyżanowska et al. (2014) or Douven, Elqayam, and Krzyżanowska (2022).[6]

The results of the empirical experiments concerning CS are somewhat mixed, but the majority of evidence seems to go against it. Cruz, Over, Oaksford, and Baratgin (2016) support CS by showing that the way participants react to instances of CS is more in line with how they typically react to valid rather than invalid inferences. At the same time, the results of Krzyżanowska et al. (2017), Douven et al. (2019) and Skovgaard-Olsen, Kellen, Hahn, and Klauer (2019) goes against CS. For example, in Skovgaard-Olsen, Kellen, et al. (2019) the authors conclude that, contrary to the results of Cruz et al. (2016), speakers tend to classify instances of CS as cases of invalid reasoning.

In light of the above, it seems that the validity of CS is still a controversial issue and therefore it may be premature to reject RH on this ground. At the same time, as far as I know, no conclusive counterexample against RH was yet proposed. Therefore, it seems that given its strong empirical standing the RH should be regarded as plausible. In the next section, I will discuss what are consequences of this strong standing of RH for RT.

4 Relevance Hypothesis and Ramsey Test

What does this all have to do with RT? QAT a probabilistic reformulation of RT, does not include the positive relevance requirement amongst the acceptability conditions of conditionals. Unsurprisingly, RT does not include the probabilistic relevance as as acceptability condition, which in light of strong

[6] For a related theories see e.g., Crupi and Iacona, 2020 or Berto and Özgün, 2021.

standing of RH, seems to be problematic. To see that, consider:

(7) If I eat an apple today, I will not inherit \$1000000 today.

Let us assume that in the case of (7), as in the case of (2), the consequent is very probable and the antecedent is probabilistically irrelevant for the consequent.[7] RT will judge (7) as acceptable; if we add the antecedent to our stock of beliefs our subjective probability of the consequent will be high. At the same time, EST will not judge it as acceptable because the antecedent is not relevant for the consequent. We can multiply similar examples.[8] In all of them our intuitions seem to go together with the verdict of EST. This advantage is confirmed by the results of empirical studies. All that together constitutes an argument against RT as a procedure for judging the acceptability of indicative conditionals.

After establishing our negative results two questions remain: what does RT really test? And, what would be a better test for the acceptability of conditionals?

A detailed answer to the first question goes beyond the scope of this article, but it seems very plausible that RT provides an interpretation for conditional degrees of beliefs as proposed by Edgington (1995) or Sprenger (2015). This interpretation is also supported by Ramsey's original formulation:

> We can say that they are fixing their degrees of belief in q given p. (Ramsey, 1990, p. 155.)

If that is the case, and if a high conditional probability of the consequent given the antecedent is not enough for a conditional to be acceptable, as is predicted by EST, it is clear that RT, which tests just a conditional probability, is not a reliable test for acceptability of conditionals.

The answer to the second question is easier. EST suggests a way in which we can upgrade RT to prevent it from accepting irrelevant conditionals. It is enough to add a clause where the subject checks if the acceptance of the

[7] Obviously, we can fix the probability of the consequent as high as we want without making the antecedent probabilistically relevant for it.

[8] Similar examples were used in an experiments described in (Douven and Verbrugge, 2012) or (Skovgaard-Olsen et al., 2016). The results of the experiments presented in the second paper suggest that neither acceptability nor probability of conditionals generally corresponds to the conditional probability of the consequent given the antecedent.

antecedent raises the probability of the consequent. Additionally, to handle conditionals with arguments which truth values are known, we add the first clause in which those beliefs are suspended. The upgraded test looks like this:

RT+

1. If you have categorical beliefs concerning truth values of p or q suspend those beliefs. Assess the probability of q.
2. Add p hypothetically to your stock of beliefs and update the rest of your beliefs in order to make them consistent with the acceptance of p. Is your subjective probability of q high?
3. Compare your degree of belief in q now with the one you obtained in the first step. Is the former higher?

If the answers to both questions (from 2. and 3.) are positive, a conditional $p \longrightarrow q$ is acceptable. RT+ preserves the intuitions behind RT and should be treated as an improved version rather than a new test. It corresponds well to EST. Therefore all the evidence which supports EST supports RT+ as well. Moreover, RT+ constitutes a generalization of RT. Because of the addition of the first step the new test can be successfully applied to the conditionals with known antecedents, which are not addressed by the original formulation of RT.

Interestingly, a similar proposal was developed in the framework of belief revision theory by Rott (1986). Rott's version of RT is called the *Strong Ramsey Test*:

(19) $A \gg B \in K \Leftrightarrow B \in K_A \;\&\; B \notin K_{\neg A}$

which means that the conditional $A \gg B$ belongs to a belief set K if and only if B belongs to set K revised in a way necessary to accept A and does not belong to set K revised in a way necessary to accept $\neg A$. This approach was further developed in (Andreas and Günther, 2019). The idea behind Rott's test and R+ is clearly the same: it is not enough, for the acceptability of the conditional, that the consequent is (likely) true when the antecedent is true, the antecedent has to be in some way responsible for the truth of the consequent. On the other hand, the two proposals cannot be directly compared, Strong Ramsey Test is defined in terms of belief revision theory and therefore full beliefs, while the RT+ is defined in probabilistic terms. Therefore, to compare both proposals, we would have to put them in a framework that combines both full beliefs and probabilistic degrees of beliefs. Such frameworks are present in the literature (see e.g., Hansson, 2020; Leitgeb, 2014) but comparing both versions of revised RT goes beyond the scope of this paper.

5 Conclusion

In my article, I described a new argument against RT. I argued that a positive probabilistic relevance requirement is one of the conditions of the acceptability of indicative conditionals. It is both supported by empirical evidence and there are no uncontroversial counterexamples to it. RT does not incorporate the requirement and therefore is not a successful procedure for judging the acceptability of indicative conditionals. At the same time, it can be easily augmented.

Declarations There are no conflicts of interest. The research was supported by Starting Investigator Grant No. 640638 ("OBJECTIVITY—Making Scientific Inferences More Objective") of the European Research Council (ERC).

Acknowledgements I would like to thank Jan Sprenger, Borut Trpin, Igor Douven, Vincenzo Crupi and the anonymous referees for their useful comments.

References

Adams, E. W. (1975). *The logic of conditionals: An application of probability to deductive logic*. D. Reidel Pub. Co.

Andreas, H. & Günther, M. (2019). On the ramsey test analysis of 'because'. *Erkenntnis*, *84*(6), 1229–1262. doi:10.1007/s10670-018-0006-8

Baratgin, J., Politzer, G., Over, D., & Takahashi, T. (2018). The psychology of uncertainty and three-valued truth tables. *Frontiers in psychology. 9*, 1479. Retrieved from http://dro.dur.ac.uk/26304/

Bennett, J. (2003). *A philosophical guide to conditionals*. Oxford University Press.

Berto, F. & Özgün, A. (2021). Indicative conditionals: Probabilities and relevance. *Philosophical Studies*. doi:10.1007/s11098-021-01622-3

Cheng, P. (1997). From covariation to causation: A causal power theory. *Psychological Review*, *104*, 367–405. doi:10.1037//0033-295X.104.2.367

Crupi, V. & Iacona, A. (2020). The evidential conditional. *Erkenntnis*. doi:10.1007/s10670-020-00332-2

Cruz, N., Over, D., Oaksford, M., & Baratgin, J. (2016). Centering and the meaning of conditionals.

Douven, I. (2008). The Evidential Support Theory of Conditionals. *Synthese*, *164*(1), 19–44.

Douven, I., Elqayam, S., & Krzyżanowska, K. (2022). Inferentialism: A manifesto. In S. Kaufmann & D. Over (Eds.), *Conditionals: Logic, linguistics, and psychology*.

Douven, I., Elqayam, S., Singmann, H., & van Wijnbergen-Huitink, J. (2019). Conditionals and inferential connections: Toward a new semantics. *Thinking and Reasoning*, *0*(0), 1–41. doi:10.1080/13546783.2019.1619623. eprint: https://doi.org/10.1080/13546783.2019.1619623

Douven, I. & Verbrugge, S. (2012). Indicatives, concessives, and evidential support. *Thinking and reasoning*, *18*(4), 480–499.

Edgington, D. (1995). On Conditionals. *Mind*, *104*(414), 235–329.

Egré, P., Rossi, L., & Sprenger, J. (2019). *De finettian logics of indicative conditionals*.

Evans, J. & Over, D. (2004). *If*. Oxford University Press.

Fermé, E. & Hansson, S. O. (2011). Agm 25 years: Twenty-five years of research in belief change. *Journal of Philosophical Logic*, *40*(2), 295–331. doi:10.1007/s10992-011-9171-9

Fuhrmann, A. & Levi, I. (1994). Undercutting and the Ramsey Test for Conditionals. *Synthese*, *101*(2), 157–169.

Gibbard, A. (1981a). Indicative conditionals and conditional probability: Reply to pollock. In W. L. Harper, R. Stalnaker, & G. Pearce (Eds.), *Ifs: Conditionals, belief, decision, chance and time* (pp. 253–256). Dordrecht: Springer Netherlands. doi:10.1007/978-94-009-9117-0_12

Gibbard, A. (1981b). Two recent theories of conditionals. In W. Harper, R. C. Stalnaker, & G. Pearce (Eds.), *Ifs* (pp. 211–247). Reidel.

Hansson, S. (2020). Revising probabilities and full beliefs. *Journal of Philosophical Logic*, 1–35.

Jackson, F. (1987). *Conditionals*. Blackwell.

Johnson-Laird, P. & Byrne, R. (2002). Conditionals: A theory of meaning, pragmatics, and inference. *Psychological review*, *109*, 646–78. doi:10.1037//0033-295X.109.4.646

Krzyżanowska, K., Collins, P. J., & Hahn, U. (2017). Between a conditionalantecedent and its consequent: Discourse coherence vs. probabilistic relevance. *Cognition*, *164*, 199–205. doi:10.1016/j.cognition.2017.03.009

Krzyżanowska, K., Collins, P. J., & Hahn, U. (2021). True clauses and false connections. *Journal of Memory and Language*, *121*, 104252. doi:https://doi.org/10.1016/j.jml.2021.104252

Krzyżanowska, K., Wenmackers, S., & Douven, I. (2014). Rethinking Gibbard's Riverboat Argument. *Studia Logica*, *102*(4), 771–792.

Leitgeb, H. (2014). The stability theory of belief. *Philosophical Review*, *123*(2), 131–171. doi:10.1215/00318108-2400575

Lycan, W. G. (2003). Real conditionals. *Philosophical Quarterly*, *53*(210), 134–137.

Oberauer, K., Weidenfeld, A., & Fischer, K. (2007). What makes us believe a conditional? the roles of covariation and causality. *Thinking & Reasoning*, *13*, 340–369.

Ramsey, F. P. (1990). General propositions and causality. In D. H. Mellor (Ed.), *Philosophical papers*. Cambridge University Press.

Rott, H. (1986). Ifs, though, and because. *Erkenntnis*, *25*(3), 345–370. doi:10.1007/BF00175348

Skovgaard-Olsen, N., Collins, P., Krzyżanowska, K., Hahn, U., & Klauer, K. (2019). Cancellation, negation, and rejection. *Cognitive Psychology*, *108*, 42–71. doi:10.1016/j.cogpsych.2018.11.002

Skovgaard-Olsen, N., Kellen, D. [D.], Hahn, U., & Klauer, K. (2019). Norm conflicts and conditionals. *Psychological review*.

Skovgaard-Olsen, N., Kellen, D. [David], Krahl, H., & Klauer, K. (2017). Relevance differently affects the truth, acceptability, and probability evaluations of 'and', 'but', 'therefore', and 'if then'. *Thinking and Reasoning*, *23*. doi:10.1080/13546783.2017.1374306

Skovgaard-Olsen, N., Singmann, H., & Klauer, K. C. (2016). The relevance effect and conditionals. *Cognition*, *150*, 26–36. 1.

Skovgaard-Olsen, N., Singmann, H., & Klauer, K. C. (2017). Relevance and reason relations. *Cognitive Science*, *41*(S5), 1202–1215. doi:10.1111/cogs.12462. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/cogs.12462

Spohn, W. (2012). *The laws of belief: Ranking theory and its philosophical applications*. Oxford University Press.

Sprenger, J. (2015). *Conditional degree of belief*.

Stalnaker, R. (1968). A theory of conditionals. In N. Rescher (Ed.), *Studies in logical theory (american philosophical quarterly monographs 2)* (pp. 98–112). Oxford: Blackwell.

Stalnaker, R. (1988). Inquiry. *Linguistics and Philosophy*, *11*(4), 515–519.

van Fraassen, B. (1976). Probabilities of Conditionals. In W. H. C. Hooker (Ed.), *Foundations of probability theory, statistical inference, and statistical theories of science*.

van Rooij, R. & Schulz, K. (2019). Conditionals, causality and conditional probability. *Journal of Logic, Language and Information*, *28*(1), 55–71. doi:10.1007/s10849-018-9275-5

Vidal, M. & Baratgin, J. (2017). A psychological study of unconnected conditionals. *Journal of Cognitive Psychology*, *29*(6), 769–781. doi:10.1080/20445911.2017.1305388. eprint: https://doi.org/10.1080/20445911.2017.1305388